Math Diversion 1076

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> You can be creative in anything — in math, science, engineering, philosophy — as much as you can in music or in or in painting or in dance.
> — Ken Robinson

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Source: http://johnrdixonbooks.com/images/Word.pdf, p. 6.
Title: Mixture Problem
 Presenter: Patrick
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1 Problem

A man has 10 gallons of a 50% sulfuric acid solution, 20 gallons of a 20% solution, and 5 gallons of a 10% solution. He wants to use up all the 10% solution and make 15 gallons of 30% solution. How much of each solution should he use?

2 Solution

Let's begin with a diagram to represent the situation.

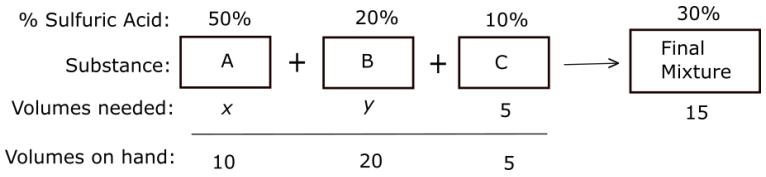

Figure 1. A place for everything and everything in its place. What to do with the information about how much of each ingredient we have on hand? We should include it in the diagram; after all, we will need to test the values of x and y to make sure they do not violate the constraints.

Balancing on overall volumes, we get

$$x + y + 5 = 15\,, \tag{1a}$$

which simplifies to

$$x + y = 10\,. \tag{1b}$$

Next, balancing on volumes of sulfuric acid, we get

$$.5x + .2y + .1(5) = .3(15)\,, \tag{2a}$$

which simplifies to

$$5x + 2y = 40\,. \tag{2b}$$

Equations (1b) and (2b) have a solution

$$x = 6\,\frac{2}{3}\,\text{gal.} \quad \text{and} \quad y = 3\,\frac{1}{3}\,\text{gal.} \tag{3}$$

Checking back with the figure, we confirm that these solutions do indeed comply with the amounts on hand of substances A and B.